Upgrade of Radiation and Cloud Parameterizations in the NOGAPS Model

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LONG-TERM GOALS

The project is intended to improve the radiation parameterization in the Navy global forecast model (NOGAPS). We are particularly interested in speeding up the computational speed of new codes that are far more flexible and accurate than the ones currently in NOGAPS.

OBJECTIVES

(i) Replace the longwave radiation code with a code that is valid for altitudes up to 80 km.
(ii) Replace the shortwave radiation code with one that accommodates absorbing aerosols and is more accurate in the near-infrared.
(iii) Develop a scheme for cloud overlap in the model.

APPROACH

Adapt a code developed by Ming-Dah Chou of NASA Goddard Space Flight Center to the Navy model.

WORK COMPLETED

We have tested the longwave code without trace gases. The results are described in the next section.

RESULTS

Figures 1-8 show a comparison of forecast errors as a function of time in hours for model runs using an older version of the Chou (1994) code and a newer version (Chou, 2001). These are five days forecasts and we are showing the improvement in selected fields. The only problem is at the highest altitudes. We suspect this is a result of an artifact in extrapolation of temperature to the highest levels.

IMPACT/APPLICATIONS

A satisfactory solution to the problem with the highest layers would be extremely beneficial to NOGAPS. It would then be possible to model high altitude releases.

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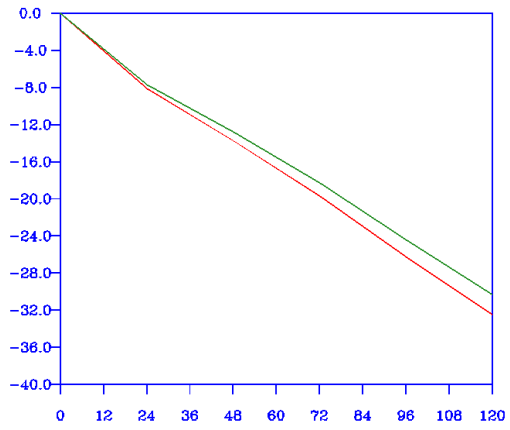
REFERENCES

Chou, M.-D., and M. J. Suarez, 1994: An efficient thermal infrared radiation parameterization for use in general circulation models. *NASA Technical Memorandum 104606*, **3**, Technical Report Series on Global Modeling and Data Assimilation. 85 pp.
Chou, M.-D., M. J. Suarez, X.-Z. Liang, and M.-H. Han, 2001: A thermal infrared radiation parameterization for atmospheric studies. *NASA Technical Memorandum-2001-104606*, **19**, Technical Report Series on Global Modeling and Data Assimilation. 56 pp.

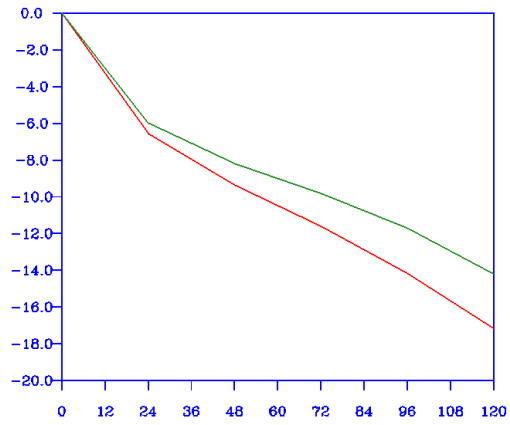
PUBLICATIONS

Harshvardhan, G. Guo, R. N. Green, Z. Qu, and T. Y. Nakajima, 2003: Remotely sensed microphysical and thermodynamic properties of non-uniform cloud fields. Submitted to *J. Atmos. Sc.*



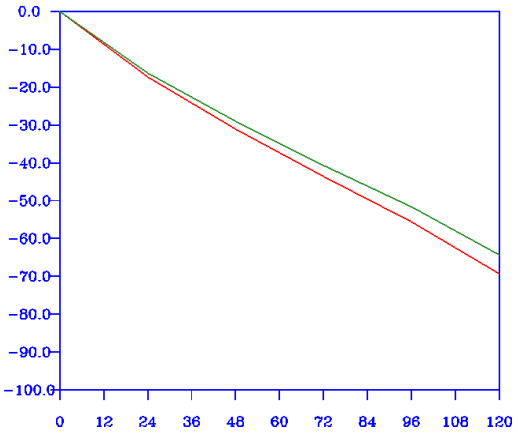
Chou 1994 Chou 2001

Figure 1. NOGAPS Data Assimilation Test - 250mb Northern Hemisphere Mean Height Error



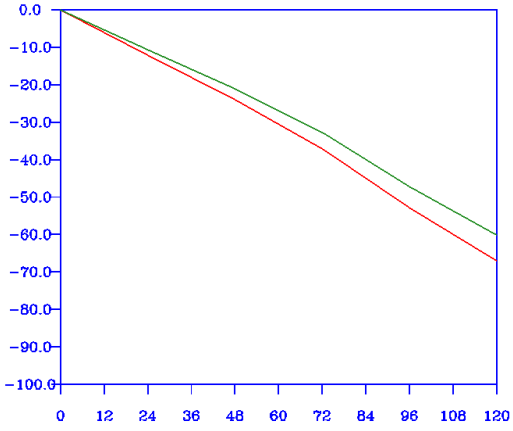
Chou 1994 Chou 2001

Figure 2. NOGAPS Data Assimilation Test - 250mb Southern Hemisphere Mean Height Error



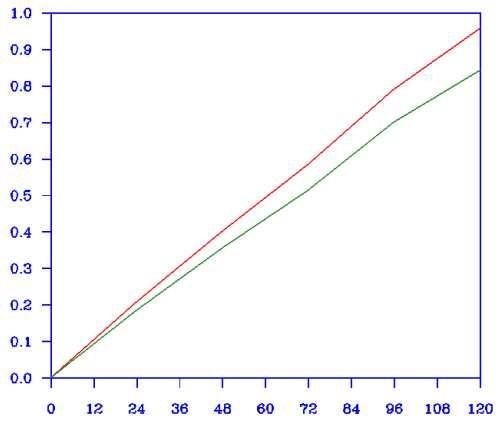
Chou 1994 Chou 2001

Figure 3. NOGAPS Data Assimilation Test - 10mb Northern Hemisphere Mean Height Error



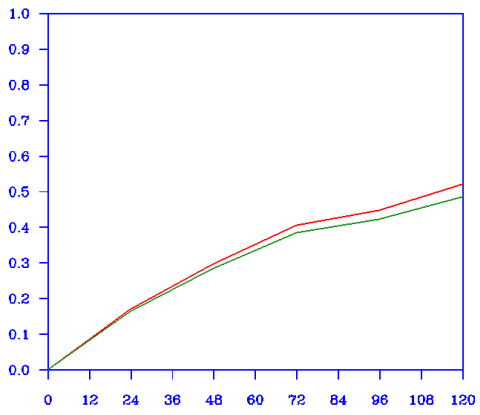
Chou 1994 Chou 2001

Figure 4. NOGAPS Data Assimilation Test - 10mb Southern Hemisphere Mean Height Error



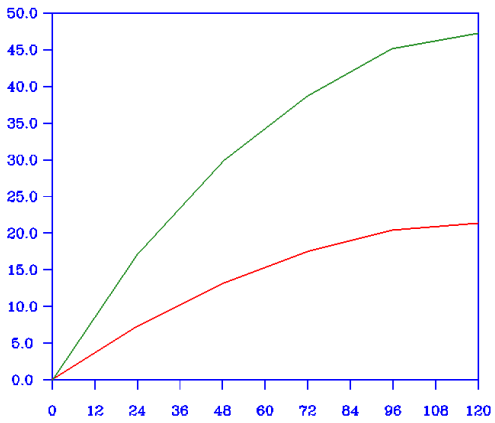
Chou 1994 Chou 2001

Figure 5. NOGAPS Data Assimilation Test - 10mb Northern Hemisphere Mean Temperature Error



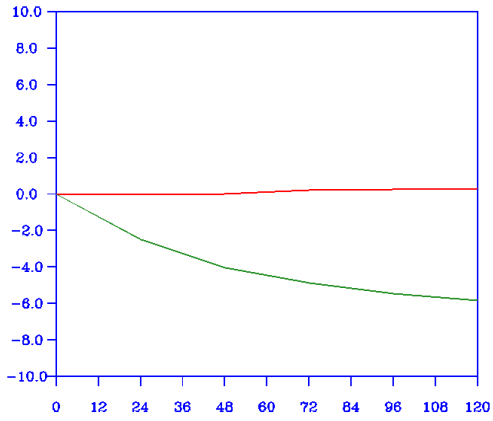
Chou 1994 Chou 2001

Figure 6. NOGAPS Data Assimilation Test - 10mb Southern Hemisphere Mean Temperature Error



Chou 1994 Chou 2001

Figure 7. NOGAPS Data Assimilation Test - 0.20mb Northern Hemisphere Mean Height Error



Chou 1994 Chou 2001

Figure 8. NOGAPS Data Assimilation Test - 0.10mb Southern Hemisphere Mean Temperature Error